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GAS ABSTRACTS

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1. GAS INDUSTRY

British Gas Research

RESEARCH IN THE [BRITISH] GAS INDUSTRY. *Coke and Gas* **9**, 17-20 (1947) *January;* 36-37 (1947) *February.*

A review is given of the Autumn Research Meeting of the Institution of Gas Engineers, in which new technical ideas are critically examined. The reports of the several committees included those of the Coal Conservation, Education, Liquor Effluents and Gas Production Committees. The Coal Conservation Committee's work was centered around the efficient utilization of fuels, which was discussed in detail. Technical salesmanship and courses set up for the training of salesmen in handling gas appliances were discussed by the Committee on Education. The Gas Production Committee's work was concentrated in the direction of complete gasification, namely (1) the gasification of coal in hydrogen under pressure for the production of city gas, using the reactive coke produced for the making of the necessary hydrogen by the Lurgi process; (2) the gasification of coal under pressure to produce city gas, selling the reactive coke as a smokeless fuel, and making the necessary hydrogen from coal or high-temperature coke or by the decomposition of part of the gas produced during hydrogenation; and (3) the combination of (1) and (2) with processes of methane synthesis. The problems and new ideas discussed included improvements made in gas holders, spent liquor disposal, prevention of flaking and other forms of disintegration of refractories, methane synthesis, purification of synthesis gas and the removal of organic sulfur compounds.

J. J. S. Sebastian

Coal Reserves

Fieldner, A. C. THE NATIONAL FUEL RESERVES AND THEIR RELATION TO THE FUTURE SUPPLY OF LIQUID FUELS. *Mech. Eng.* **69**, 221-228 (1947) *March.*

This report gives a detailed discussion of the mineral fuel reserves of the United States, including solid, liquid and gaseous fuels, as of January 1, 1946, based on estimates made by the U.S. Geological Survey. The total coal reserves of 3200 billion tons comprise about 40-50% of the world reserves of all ranks of coal. Excluding fissionable materials, coal comprises 98.8% of our mineral fuel energy reserves, oil shale 0.8%, petroleum 0.2% and natural gas 0.2%. Our proved petroleum and natural gas reserves are equivalent in heating value to only 4.8 billion and 5.2 billion tons of coal, respectively, assuming a heating value of 1300 Btu per lb. of coal. At the present rate of production, our petroleum and natural gas reserves will probably become exhausted in 12.3 and 34 years, respectively, unless discoveries of new fields increase the reserves. Thus it will ultimately be necessary to resort to coal and other sources of energy (such as nuclear energy from fissionable materials), either by direct substitution or by conversion of solid fuels to liquid and gaseous fuels. Fuel gases from coal by carbonization or complete gasification have long been in commercial use. In recent years processes have been developed, and are being perfected by continued research, for the conversion of coals to liquid fuels, either directly by hydrogenation of coal or by the hydrogenation of tars and gases produced from coal. As to various ranks of coal, the total coal reserves of the United States consist of anthracite 0.5%, low volatile bituminous coal 2.5%, high volatile bituminous coal 55%, subbituminous coal 23% and lignite 19%. The report includes a thorough discussion, supported by statistical data and illustrated by maps, of the regional distribution of various ranks of coking and non-coking coals.

J. J. S. Sebastian

Hydrocarbon Research

Spaght, M. E. FUTURE RESEARCH IN HYDROCARBONS. *Chem. Eng. News* **25**, 1122 (1947) *April* 21.

Over $50,000,000 are spent annually for research on hydrocarbons, most of which come

from natural gas and petroleum. The goals of such research programs are: (1) To develop and maintain a supply of raw material; (2) To improve existing processes; (3) To improve and find new uses for existing products; (4) To develop new processes; and (5) To develop new products.

R. S. Goodrick

Natural Gas Act

Hawkins, W. THE NATURAL GAS ACT AND THE OIL AND GAS PRODUCER. *Oil Weekly* 125, 53-54 (1947) *April* 21.

An attack on the administration of the Natural Gas Act by the Federal Power Commission is presented. It is claimed that the FPC is in a planned campaign to nationalize control of the oil and gas industries through unauthorized extensions of its original jurisdiction. Congressional action to restore the original meaning and limitations of the Natural Gas Act is suggested as the only remedy.

H. R. Batchelder

Natural Gasoline Industry

Tuttle, R. B. NATURAL-GASOLINE AND CYCLING INDUSTRY OPERATING AT 91 PER CENT OF CAPACITY. *Oil Gas J.* 45, 140-1, 143-4, 146, 148 (1947) *April* 26.

Results of a survey of the natural gasoline and cycling industry are reported. Location and capacity of the plants are presented.

R. S. Goodrick

Natural Gas Reserves

PROVED NATURAL GAS RESERVES RISE. *Am. Gas Assoc. Monthly* 29, 174-177, 203 (1947) *April.*

Proved natural gas reserves in the continental United States on December 31, 1946 were 160.6 trillion cubic feet and proved liquid hydrocarbon reserves were 24,194,587,000 barrels, estimated the first joint report of the Committees on Reserves of the American Gas Association and the American Petroleum Institute. The joint report marked a new method of estimating the nation's petroleum sources. The proved natural gas reserves of 160.6 trillion cubic feet represent an increase of 12.8 trillion cubic feet or about 8.0 percent over proved reserves of 147.8 trillion cubic feet estimated on December 31, 1945. The estimated net production of natural gas for the year 1946 is 4.9 trillion cubic feet after deducting the amount of gas returned to reservoirs.

Editor's abstract

Note: This article also appeared in *Gas Age* 99, 24 (1947) *March* 20.

Safety

Breeland, A. W. ACCIDENTAL IGNITION OF GAS. *Gas* 23, 54-55 (1947) *March.*

See *Gas Abstracts* 3, 54 (1947) *April* for abstract.

2. APPLIANCES

Hot Water Tanks

Hoover, C. P. FAILURE OF DOMESTIC HOT WATER STORAGE TANKS. *Corrosion* 3, 185-191 (1947) *April.*

A report of experimental work conducted to determine the causes of failure of hot water storage tanks and methods of preventing the same. The contributing causes of tank failure are (a) poor tank steel, (b) poor galvanizing, (c) dissimilar electro-chemical metals. Methods of preventing corrosion are by (a) deaerating water, (b) hardening the water to form a protective scale on tank wall, (c) addition of sodium silicate to form a protective scale, (d) addition of polyphosphates to pre-

vent excess deposit in cold water line, (e) maintaining a chemical balance to calcium carbonate, or slightly in excess, (f) supersaturating the water with calcium carbonate to insure a protective scale on tank wall.

E. F. Davis

Hot Water Tanks

Bialosky, J. M. CORROSION OF GALVANIZED HOT WATER STORAGE TANKS. *Corrosion* 3, 192-197 (1947) *April.*

The same general conclusions are drawn as those given by Hoover (cf. preceding abstract) with the following additional recommendations: (a) Select a tank of suitable capacity to meet the maximum requirements; (b) Use a heavy gauge material in construction to restrict mechanical "breathing"; (c) Insulate tank to permit the lowest rate of heating; (d) Use a thermostat to limit the maximum water temperature; (e) Use a pressure relief valve to limit the maximum water pressure.

E. F. Davis

Panel Heating

Hutchinson, F. W. RESPONSE AND LAG IN THE CONTROL OF PANEL HEATING SYSTEMS. *Heating, Piping, Air Conditioning* 19, 111-117 (1947) *February.*

This paper describes a panel heated test house which is in service on the Purdue University Research Housing Campus. The five-room residence is equipped with four independent sinuous-coil type hot-water panel systems located in the floor, ceiling, exterior walls, and interior partitions. Five different methods of controlling the panel heating are installed and have been tested. All tests reported in this paper are for ceiling panels only and were conducted with constancy of living room air temperature as a criterion of control; if optimum comfort had been the criterion, the inside air temperature would have had to be varied as an inverse function of load. Test results show periodicity of panel surface temperature for both of the control methods which use off-on operation (or modulating sequence operation) of the burners as a means of regulating the energy input to the heating system. The period varies with load and with control method, but is of the order of two hours per cycle with a change in temperature of the surface (at constant impressed load on the structure) of approximately 6°F. When control methods are used which permit regulation of energy input by blending recirculated water with boiler water at fixed temperature, the periodicity no longer occurs and stable control is, in general, realized; of three systems of this type which were tested, best results were obtained from the one using a modulating room thermostat to fix the setting of a temperature sensitive element in the discharge line from the mixing valve; this element then controlled the position of the valve. For a more stabilized method of control the best results were obtained using a modulating control to fix the energy input into the system.

E. F. Davis

3. COMBUSTION AND INDUSTRIAL FURNACES

Gas Turbine

Yellott, J. I. THE GAS TURBINE POWER PLANT—III. *Power Plant Eng.* 51, 104-107, 140, 142, 144, 146 (1947) *April.*

This continues the first textbook showing you how to calculate the plant as a whole...You can figure how a gas turbine plant might be built to fit your conditions...How to calculate and co-ordinate essential components of gas turbine power plant...Requirements and characteristics of compressors, air heaters, combustors...How characteristics of axial, centrifugal and positive displacement compressors work into design of plant...Details of characteristics and performance of each type...How to design air heaters and regenerators...How to calculate dollar value of regenerator...A new combination of regenerative and combus-

tive air heaters . . . How combustors are designed . . . Pressure combustion . . . Ignition of fuel . . . Velocities of air in ducts . . . Combustor efficiency and operation . . . Insulation and metals for combustors . . . Turbine calculations in Part IV.

Author's abstract

4. CARBONIZATION AND GASIFICATION

Benzol Recovery

Holmes, G.L.C.C. BENZOL RECOVERY PLANT AT LIVERPOOL GAS COMPANY'S GARSTON WORKS. *Gas J. (British)* 249, 561-562, 565-566 (1947) *March* 19.

Steps taken at the Liverpool Gas Company to reduce the sulfur content of gas supplied indicates that a reduction of sulfur to approximately 10 grains per 100 cu.ft. of gas is economically associated with the maximum possible recovery of benzol from coal gas. Further reduction is dependent on a catalytic process which now seems to have reached a stage where it may be applied on a large scale. A benzol sulfur recovery plant was designed to handle 7.5 million cu.ft. of gas per day at the Garston Works of the company. Calculations envisaged a continuous recovery of 90% of the benzol content of the gas and the removal of 85% of the organic sulfur compounds other than COS and similar volatile compounds. The article describes the plant in detail and operating results are presented.

H. T. Inatomi

Carbonization

Carter, G. W. COAL LOGS PROCESSES FOR COAL CARBONIZATION. *Chem. Eng. Progress* 43, 180-182 *"Trans. Section"* (1947) *April.*

This continuous process, recently developed by the Coal Logs Co. Inc., was designed for low as well as high temperature carbonization of Utah bituminous coals and will soon be ready for commercial application. In the low temperature section, a ½-1½ inch thick bed of slack coal is moved forward in a vibrated horizontal retort, which is 37 in. wide and 13 ft. long and is heated by electric energy. At the discharge end, the plastic coal, having a temperature of 750-950°F., is compressed at a pressure of 40 psi and is extruded to produce strong cylinders of solid smokeless fuel, called "coal logs." One ton of bituminous coal yields about 1400 lb. of semicoke, 25 gal. of oil and 1200 cu.ft. of 1000 Btu gas. An unusually rapid rate of heat transfer results from agitation of the coal by vibration, which is claimed to be the key to the economical distillation of coal at low temperatures. The time of throughput is 1-3 minutes. Partially refined fractions of coal tar of distinct chemical and physical characteristics are obtained, the high yield being due to the absence of secondary decomposition of hydrocarbon vapors.—In the second step of the process the coal logs are further carbonized in a chamber heated to 1475-1850°F., the resulting product being a strong high temperature coke. The time of travel through this unit is 10-15 minutes.

J. J. S. Sebastian

Gasification Project

HUGE PROJECT WILL CONVERT COAL TO GAS. *Am. Gas Assoc. Monthly* 29, 167, 204 (1947) *April.*

The proposed project at Library, Pennsylvania of the Pittsburgh Consolidation Coal Company and Standard Oil Development Company for the gasification of coal is expected to produce 2,400,000 cu.ft. of gas/day, equal to the output of the Big and Little Inch pipelines.

R. S. Goodrick

Gasification Project

Bland, W. F. GASIFICATION OF COAL MAY FORESHADOW NEW INDUSTRY REPLACING OIL REFINERIES. *Natl. Petroleum News* 39, 23-24 (1947) *April* 2.

Standard Oil of N.J. and Pittsburgh Consolidation Coal Co. have announced plans for joint research and operation of a pilot plant at Library, Pa. for gasifying coal and converting it to liquid fuels, high Btu gas, and chemicals. If the plan is successful, present day users of petroleum refinery products may get their products from coal refineries in the future. Estimates vary on the amount of gas which would be obtained from the coal, ranging from 7500 b/d of gasoline and 260,000,000 cu.ft. gas per day from an annual consumption of 6,000,000 tons of coal to 10,000 b/d of gasoline and 40,000,000 cu.ft. per day of gas from an annual consumption of 2,000,000 tons of coal.

R. S. Goodrick

Organic Sulfur Removal

Darlington, F. H. ORGANIC SULFUR REMOVAL PROCESS. *Am. Gas Assoc. Monthly* 29, 147 (1947) *March.*

The author describes an organic sulfur purification process, originally published by E. J. Menerey (*A.G.A. Proceedings* 1931, 1082-1085), which has been in use at a New Jersey glass plant for the past 17 years. At a pressure of 10 psi and temperature of 800°F., magnesium sulfate—zinc oxide catalyst is used for the conversion of organic sulfur compounds contained in carburetted water gas to hydrogen sulfide. The gas to be purified is preheated to 800°F., entering the catalyst chamber at the top and leaving at the bottom at a temperature of about 650°F., and is then cooled to 100-150°F. The H_2S formed is removed in an oxide purifying box. The organic sulfur content of carburetted water gas is thus reduced from 15 to less than 3 grains per 100 cu.ft. Weekly revivification of the catalyst is required. This is done by passing air through the catalyst for 12 hours at a rate of up to 8 cu.ft. per minute, the material being discarded and replaced once in six months. The cost of the equipment is $6000 at present, and the total operating cost, including interest and depreciation, is 5.4 cents per Mcf. The capacity of the equipment is 4000 cu.ft. per hour.

J. J. S. Sebastian

Underground Gasification

Stedman, G. E. UNDERGROUND COAL GASIFICATION. *Gas Age* 99, 13-15, 58-60 (1947) *March* 20.

A well illustrated description is given of the underground gasification experiments conducted by the U.S. Bureau of Mines and the Alabama Power Company at Gorgas Mine, Alabama, which recently has attracted national attention. The main objective at this time is the control of the combustion of the coal underground without particular regard to Btu or gas quality. Two parallel, 150-ft. long entries were driven into a 36 in. thick coal seam outcropping on a hillside. The 6 ft. by 3 ft. entries, both lined with clay bags, were connected at their farthest end by a 40 ft. long crosscut, enclosing a block of about 1000 tons of coal. The shallow top (33 ft.) above the block was pierced with 5 rows of 4 bore holes into which 4 in. standpipes were installed to sample the gas and measure the temperature and pressure. Air, at a rate of 6000-7000 cu.ft. per hr., was pumped into one of the entries, the gaseous products leaving through the other entry. The flow can be reversed at any time and steam blown in, either together with the air or in a subsequent period. The fire was started by dropping a thermite bomb through one of the bore holes at the top. The highest temperatures recorded so far have been about 2200°F., the pressure ranging from zero to 48 in. water gauge. After the experiment is completed the burned area will be steamed for several days, flooded with water, and the strata of rock above the seam removed in order to examine the residues of gasification. The experiments have thus far proved that it is possible to control and direct the combustion, and to make an air blown producer gas of 50-150 Btu or a synthesis gas of up to 250 Btu by alternately blowing steam and air (or oxygen) through the burning seam. It is believed that the underground gasification at greater depth would work better.

J. J. S. Sebastian

5. NATURAL GAS AND NATURAL GAS CONDENSATES

Corrosion Prevention in Condensate Fields

Thornton, D. P., Jr. REMEDIES STUDIED FOR FREAKISH CORROSION OCCURRING IN SOME CONDENSATE FIELDS. *Petroleum Processing* **2**, 273-279 (1947) *April.*

Although a considerable amount of work has been done on corrosion in gas condensate fields, the problem is far from being solved, and in some fields the cost of replacement of corroded equipment has been as much as $1,000,000. The randomness at which the time and place corrosion takes place makes it impossible to foresee it, but there are indications that X-ray studies on the well fluid of a new oil field may reveal the type of corrosion that may take place and the type of compound that may be used as inhibitor. As yet, an inexpensive resistant alloy for tubing is not available; however, chemical inhibitors and protective coatings appear promising. The most successful inhibitor is Kontrol "115" made by Tretolite Co. A new technique for coating Bakelite on tubing looks promising.

S. Mori

Formation Volume of Oil and Gas

Sage, B. H. and Olds, R. H. VOLUMETRIC BEHAVIOR OF OIL AND GAS FROM SEVERAL SAN JOAQUIN VALLEY FIELDS. *Petroleum Technology* **10**, TP-2153 (1947) *March.*

The formation volume for materials collected from four fields in the San Joaquin Valley was studied over a fair range of temperature and pressure. All samples collected had a gas-oil ratio greater than 5000 cu.ft. per bbl. For these materials a very simple correlation of formation volume in terms of temperature, pressure and gas-oil ratio is presented.

J. D. Parent

Gas Transportation Calculations

Miller, B. GAS TRANSPORTATION SYSTEM CALCULATIONS. *Gas Age* **99**, 17-21 (1947) *April* 3.

The general flow equation is presented without derivation. The friction factor is replaced by $1/C_F$ where C_F is called the flow coefficient; some equations for evaluating C_F are given without derivation. The assumptions implicit in the derivation of the general flow equation are stated. It is stated that the decrease in actual flow rate with respect to that calculated on the basis of no allowance for joints, bends, etc., is about 5 to 10% so that the pipe line "efficiency" is from 90 to 95%.
Abstractor's note: In the second paper Mr. Miller uses C_F outside the square root expression; this changes the value from that indicated above. The above usage may be due to a typographical error.

J. D. Parent

Hydrates Elimination

Weber, G. CARTHAGE ENGINEERS FIGHT HYDRATES. *Oil Gas J.* **45**, 58-60, 98 (1947) *April* 5.

Considerable difficulty due to hydrate formation was encountered at the Carthage Field during the past winter. Methods used for inhibiting hydrate formation and for removing hydrate once it was formed are related. Heating and decreasing turbulence were the two most important means used.

J. D. Parent

Installing Propane-Air Mixtures

Wenzel, L. R. SAFETY PRECAUTIONS WHEN INSTALLING PROPANE-AIR MIXTURES. *Am. Gas J.* **166**, 19, 22-23 (1947) *March.*

The author not only tabulates the safety precautions necessary in handling butane and pro-

pane gas but very thoroughly reviews the characteristics of these gases. Standard methods for reducing excessive pressures in tanks are described. Proportioning systems for mixing propane or butane with air in order to eliminate hazards are fully explained.

E. M. Rueck

Natural Gas Storage

Claxton, C. R., Markle, M. G. and Meiller, D. V. STORAGE IN BURIED PIPE. *Am. Gas Assoc. Monthly* 29, 171-3 (1947) *April.*

This article was abstracted in *Gas Abstracts* 3, 59 (1947) *April.*

Natural Gas Utilization

Bludworth, J. E. CHEMICALS FROM PETROLEUM. *Oil Gas J.* 45, 76-77, 87-89 (1947) *April* 12.

The production of chemicals from natural gas leads to a wide variety of oxygenated compounds. Chemical reactions based on acetaldehyde are discussed as an indication of the number of possible derivatives which can result.

C. H. Riesz

Natural Gas Utilization

Smith, H. M. and Holliman, W. C. UTILIZATION OF NATURAL GAS FOR CHEMICAL PRODUCTS. *U. S. Bureau Mines I.C.* 7347 (1947) *March.*

A very general and mostly non-technical review of the various methods of utilization of natural gas components, and of the products resulting is presented. A bibliography of 218 references is appended.

H. R. Batchelder

Plastic Tubing

Herr, F. A. PLASTIC PIPING FOR GAS SERVICES. CHARACTERISTICS AND METHODS OF INSTALLATION. *Am. Gas J.* 166, 16-18, 58 (1947) *March.*

For five years the Southern California Gas Company of Los Angeles has experienced satisfactory results using a Tenite II base plastic piping in their gas distribution system. The problem of making metal to plastic connections remains unsettled. Plastic piping of this type cannot be installed in rocky soil nor exposed to wet gas because of the rapid deterioration under these conditions.

E. F. Davis

Reducing Leakage

Willien, L. J. PROPOSED METHOD OF REDUCING LEAKAGE ON CHANGE-OVERS. *Gas Age* 99, 31, 59-60 (1947) *April* 3.

It is pointed out that there is a continuous deposition of water and oil in distribution lines when a manufactured gas is supplied. Natural gas and propane-air are "dry" gases and do not supply these substances to the pipe walls and joints. Yarn or jute packing swells in moisture and joints are kept tight when a wet gas is supplied. If a switch is made to a dry gas such packings are dried out and shrunk causing leaks. Rubber gaskets are swollen by oils so that a similar situation exists with this material. Further, oil lubricates and permits free movement of the gasket on the pipe surface. Mr. Willien recommends treating the distribution lines with a relatively non-volatile oil before making a change-over from a wet gas to a dry gas if rubber gasketed Dresser couplings are in use.

J. D. Parent

Transmission

Potter, L. T. EFFICIENT TRANSMISSION SYSTEM OPERATION DURING PEAK DEMAND PERIODS. *Gas Age* 99, 18-19, 62 (1947) *March* 20.

The following factors determine effective peak capacity: (1) Maximum capacity of the system under straight flow conditions (including avail-

ability at sources of supply), (2) character of the demand at high load and (3) net available line storage capacity. Item No. 3 is normally the most important. Accurate knowledge of effective system capacity as revealed by a thorough analysis of operating data is necessary before decisions can be made on changes of facilities.

J. D. Parent

Transmission

Reed, P. TEXAS EASTERN'S EXPANSION PLANS INCLUDE NEW TECHNIQUES. *Oil Gas J.* 45, 40-41 (1947) *April* 5.

Some unusual problems are presented. Thus, it is stated that studies are being made to determine the feasibility of transporting LP-gas to the East in the 20 inch line during the summer season. Consideration is being given to the use of experimental centrifugal compressors while delivery is awaited on reciprocating units. Consideration is being given to the transmission of gas produced in Pennsylvania by coal gasification. A unique item is the plan to obtain gas by feeding into the systems of the United Gas and Arkansas-Louisiana companies and to take gas at cross-over points into the "Inch" lines.

J. D. Parent

6. PETROLEUM AND SYNTHETIC LIQUID FUELS

Desulfurizing and Hydroforming

Lee, M. W. (to Union Oil Co.) DESULPHURIZATION AND HYDROFORMING. *U.S.* 2,417,308 (1947) *March* 11.

A two stage process of desulphurization and hydroforming of hydrocarbon feed mixture containing sulfur compounds is claimed. The feed is subjected to vapor phase desulphurization at 600-850°F. employing cobalt molybdate catalyst and then to vapor phase hydroforming at 850-1500°F. requiring superatmospheric pressures and hydrogen.

M. C. Miyaji

Desulfurizing Petroleum

Ayers, G. W., Barton, D. M. and Harton, E. E. (to The Pure Oil Co.) REMOVAL OF SULFUR COMPOUNDS FROM HYDROCARBON OILS. *U.S.* 2,417,041 (1947) *March* 11.

A specially prepared reagent is used to remove small quantities of residual sulfur as well as sulfur and sulfur compounds from hydrocarbon oils which had been treated with caustics. The reagent preparation using a powdered alloy and a hydrogenation catalyst is described. The reagent may be used to treat gasoline or other liquid hydrocarbons at temperatures up to 100° C. or higher.

E. M. Rueck

Lubricating Oils

Pritzker, G. G. PRODUCTION OF SYNTHETIC LUBRICATING OILS BY HYDROGENATION REACTIONS. *Petroleum Processing* 2, 205-208 (1947) *March.*

The development of the hydrogenation process for producing synthetic lubricating oils from coal, tar, crude oil, etc., is reviewed briefly.

C. H. Riesz

7. ANALYTICAL METHODS AND TESTS

Aromatic Hydrocarbons

Lipkin, M. R. and Martin, C. C. CALCULATION OF WEIGHT PER CENT RING AND NUMBER OF RINGS PER MOLECULE FOR AROMATICS. *Anal. Chem.* 19, 183-189 (1947) *March.*

A method is described of determining per cent ring and average number of rings per molecule from density and density coefficients which are derived from mid-boiling point and density. These determinations are accurate to within 3% ring and 0.1 ring per molecule, compared with data on pure compounds. Aromatics containing a naphthene ring or olefin double bond in the same molecule interfere with this method of analysis; however, these compounds are not usually present in sufficient concentration in petroleum fractions boiling below 400°C. to affect significantly the accuracy of the analysis. Tables and graphs of data are given.

M. Nolt

Gasoline Analysis

Kurtz, S. S., Jr., Mills, I. W., Martin, C. C., Harvey, W. T., and Lipkin, M. R. DETERMINATION OF OLEFINS, AROMATICS, PARAFFINS, AND NAPHTHENES IN GASOLINE. *Anal. Chem.* 19, 175-182 (1947) *March.*

A method of analysis is presented for the determination of olefins, aromatics, paraffins, and naphthenes in gasolines. The advantage of the method over the method previously available in the literature is that it is more reliable, especially for samples rich in olefins and aromatics. The improved procedures and a system of internal cross checks ensure the accuracy of the analysis.

M. C. Miyaji

Hydrocarbon Standards

Streiff, A., Murphy, E. T., Cahill, J. C., Flanagan, H. F., Sedlak, V. A., Willingham, C. B. and Rossini, F. D. PURIFICATION, PURITY, AND FREEZING POINT OF 8 NONANES, 11 ALKYLCYCLOPENTANES, 7 ALKYLCYCLOHEXANES, AND 4 BUTYL-BENZENES OF THE API-STANDARD AND API-NBS SERIES. *J. Research Natl. Bur. Standards* 38, 53-94 (1947) *January.*

This paper describes the procedures followed in the preparation of 29 hydrocarbons for the API-Standard and API-NBS series of standard hydrocarbons. The present series includes 8 nonanes, 11 alkylcyclopentanes, 6 alkylcyclohexanes and 4 butylbenzenes. The procedure consists essentially of distillation at a high reflux ratio, and verifying the purity of the distillate by means of freezing point determinations. In addition, boiling points and refractice indices were measured. The results of the distillations with estimates of the purity of the different fractions are shown graphically in fifty-three charts.

S. Katz

Oxygen in Coal

Spooner, C. E. THE DIRECT DETERMINATION OF OXYGEN IN COAL. *Fuel* 26, 15-23 (1947) *January-February.*

An introduction stressing the history of published methods for determining oxygen in coal and in organic substances serves to forcibly demonstrate the need for improved techniques for direct oxygen analysis. Research leading to the development of a rapid and accurate method was carried out in the author's laboratory. The analysis depends upon the thermal decomposition of the sample in the absence of air, with oxygenated products subsequently converted to carbon monoxide by passage over hot carbon. Carbon monoxide thus formed is catalytically oxidized over hopcalite to carbon dioxide which is absorbed on ascarite and weighed. A stream of purified nitrogen is used to sweep decomposition products through the absorption train. It is claimed that the reaction can be brought to completion in twenty minutes at 1200°C. A few results obtained for the oxygen content of various coals by this method compare with oxygen calculated by difference to $\pm 0.1\%$.

Abstractor's Comment: In the reviewer's opinion, the apparatus employed appears unnecessarily cumbersome, but the procedure, in general, offers a great many advantages over older methods. 67 references.

H. Hakewill

Physical Research Methods

Webb, G. M. PHYSICAL RESEARCH METHODS INCREASE KNOWLEDGE OF CATALYSTS, HYDROCARBONS. *Oil Gas J.* **45**, 203-211 (1947) *March* 23.

Modern research and control laboratories are finding it increasingly necessary to supplement classical chemical methods of analysis with new, and often unfamiliar tools borrowed from the physicist. In no field has this been more true than in petroleum research and technology. This article outlines in qualitative semi-technical language the use of X-ray and electron diffraction surface area measuring equipment, infra-red, ultraviolet and Raman spectroscopy, and mass spectrometry. Applications of X-ray diffraction to the solution of problems of catalyst structure are described in some detail.

S. Katz

Spectroscopic Analysis

Gordon, R. R., Powell, H. and Tadayyon, J. SPECTROSCOPIC ANALYSIS: APPLICATION OF THE HYDROGEN DISCHARGE LAMP TO THE ANALYSIS OF MIXTURES OF C_8 AROMATIC HYDROCARBONS. *J. Inst. Petroleum* **33**, 103-112 (1947) *February.*

For the ultraviolet analysis of hydrocarbons, the divided beam spectrophotometer is commonly used in conjunction with a discontinuous light source, such as the tungsten-iron arc. The absorption spectrum is usually photographed and matched by eye. The present paper describes the use of a continuous light source (the hydrogen discharge) in conjunction with a photoelectric densitometer. The relative merits of both procedures are compared.

Abstractor's Note: This paper will be of interest principally in those laboratories in which photographic spectrophotometry is still used, a procedure which is rapidly becoming obsolete in this country.

S. Katz

Standard Method of Gas Analysis

Shepherd, M. ANALYSIS OF A STANDARD SAMPLE OF NATURAL GAS BY LABORATORIES COOPERATING WITH THE AMERICAN SOCIETY FOR TESTING MATERIALS. *J. Research Natl. Bur. Standards* **38**, 19-51 (1947) *January.*

A synthetic mixture of gases containing CO_2, N_2, CH_4, C_2H_6, and C_3H_8 in proportions similar to those occurring in natural gas was prepared at NBS and distributed to thirty cooperating laboratories for the purpose of gathering information required to standardize the analysis of gaseous fuels. The true composition of the standard sample was unknown, but specific gravity and heating value were carefully determined so that data could be obtained on: (1) reproducibility, (2) accuracy of the computed specific gravity, (3) relation between the measured and the computed heating value, and (4) ability to determine correctly the absence of oxygen. Each different type of apparatus and technique utilized by the laboratories that performed the analyses is described in detail and indicated, along with all results reported for that particular method of analysis. Figures are also given for analyses made by means of distillation and by the mass spectrometer. Numerous graphs and tables of the data obtained are included in this survey. In many cases excellent reproducibility between different laboratories is shown; but in other instances the agreement even between different operators in the same laboratory was poor. It was concluded that while some degree of standardization already exists for the accepted methods employed in gas analysis, further investigation and standardization is very much needed.

H. Hakewill

Sulfur Compounds in Gasoline

Moriarty, F. C. EVALUATION OF SULFUR COMPOUNDS IN GASOLINE. *Petroleum Engr.* **18**, 167, 170, 172 (1947) *February.*

Since it is becoming increasingly more difficult to obtain crudes of low sulfur content, it is necessary to carefully evaluate the sulfur pres-

ent in the gasoline produced so that proper treatment can be prescribed for its elimination. Mr. Moriarty describes practical schemes for the routine sulfur analysis of gasolines produced from high sulfur crudes. Deleterious effects caused by the presence of sulfur in gasoline are discussed and processes are recommended for the destruction of the various types of troublesome sulfur compounds. This article reviews the situation that will face most petroleum organizations in the near future with the intention of stirring up further investigation on the subject.

H. Hakewill

8. GENERAL AND PHYSICAL CHEMISTRY

Equation of State for Gases

Joffe, J. A NEW EQUATION OF STATE FOR GASES. *J. Am. Chem. Soc.* 69, 540-542 (1947) *March.*

A new equation of state for gases is proposed in which all the constants may be calculated from the critical values of the pressure, temperature and volume without reference to experimental data. The equation is a somewhat complicated algebraic expression of pressure as a function of volume and temperature, and is of the fifth degree in the volume and the 5/2 degree in temperature. The equation appeared to possess the same degree of accuracy as the Beattie-Bridgeman equation when applied to a series of hydrocarbons over a range of reduced pressures from 1.0 to 2.4. When tested for nitrogen, the average deviation was 0.61% as compared with 1.80% for the Van der Waals equation between —146° to 400°C.

S. Katz

Reaction Kinetics

Harris, G. M. KINETICS OF HOMOGENOUS GASEOUS REACTIONS IN FLOW SYSTEMS. *J. Phys. & Colloid Chem.* 51, 505-540 (1947) *March.*

Reaction rate equations are presented for certain homogeneous irreversible processes occurring at constant pressure. Two extreme cases are considered: diffusion rate negligible compared to flow rate and vice versa.

J. D. Parent

Vapor Pressures

Stull, D. R. VAPOR PRESSURE OF PURE SUBSTANCES—INORGANIC COMPOUNDS. *Ind. Eng. Chem.* 39, 540-550 (1947) *April.*

This article presents vapor pressure data for about 300 inorganic compounds.

R. S. Goodrick

9. ORGANIC CHEMISTRY

Alcohols by the OXO Process

MANUFACTURE OF PRIMARY ALCOHOLS BY THE OXO PROCESS. *Coke & Gas (British)* 9, 61-65 (1947) *March.*

The OXO process consists in the liquid phase reaction of olefins with olefins in the presence of standard (Co-ThO_2-MgO-kieselguhr) Fischer-Tropsch catalyst at 100-200°C. and 100-150 atmospheres pressure. Aldehydes produced as a primary product have one more carbon atom than the olefin used and can readily be hydrogenated to the corresponding alcohol. Experimental and full-scale operation practiced by Ruhrchemie and I-G. are discussed. While the process was developed because of the unavailability of natural fats, its logical position appears to be for the production of organic compounds, especially aldehydes and alcohols, rather than for soap-manufacture.

C. H. Riesz

Cracking Paraffin Hydrocarbons

Komarewsky, V. I. and Ulick, S. C. CRACKING OF PARAFFIN HYDROCARBONS IN THE PRESENCE OF ALUMINUM CHLORIDE. *J. Am. Chem. Soc.* 69, 492-495 (1947) *March.*

The normal paraffin hydrocarbons—n-hexane, n-heptane and n-octane—were each subjected to the action of aluminum chloride-hydrogen chloride at the boiling temperature of the individual hydrocarbon. The main reaction was the production of isobutane, one mole of isobutane being formed per mole of paraffin reacted. This dealkylation reaction appeared to be a direct function of the aluminum chloride concentration since 0.2 mole of aluminum chloride was required per mole of n-heptane reacted. Polymerization-depolymerization of the cracked fragments produced isoparaffins although none boiling higher than the original hydrocarbon were recovered. Since no n-butane was found, it is believed that isomerization of the normal paraffin preceded cracking.

C. H. Riesz

Infrared Absorption Spectra of Cyclopentanes

Plyler, E. K., Stair, R. and Humphreys, C. J. INFRARED ABSORPTION SPECTRA OF SEVEN CYCLOPENTANES AND FIVE CYCLOHEXANES. *J. Research Natl. Bur. Standards* 38, 211-228 (1947) *February.*

This work represents a further contribution to the data on infrared spectroscopy of the A.P.I. Research Project No. 44. Infrared spectra are plotted and principal absorption bands are given for cyclopentane, methylcyclopentane, 1, 1-dimethylcyclopentane, trans-1, 2-dimethylcyclopentane, trans-1, 3-dimethylcyclopentane, cis-1, 2-dimethylcyclopentane, cis-trans-cis-1, 2, 4-trimethylcyclopentane, cyclohexane, methylcyclohexane, 1, 1-dimethylcyclohexane, trans-1, 2-dimethylcyclohexane and cis-1, 2-dimethylcyclohexane in the liquid phase. A Perkin-Elmer infrared spectrometer was used with an automatic slit control mechanism. The hydrocarbons were supplied by the Chemistry Division of the Bureau of Standards and are in all cases better than 99.5% pure.

S. Katz

Plastics from Petroleum Chemicals

Weil, B. H. PLASTIC MAKERS LOOK TO PETROLEUM CHEMICALS FOR RAW MATERIALS. *Petroleum Processing* 2, 215, 218-22, 224 (1947) *March.*

The production of plastics in 1945 was double that in 1941 while present expansion programs will double the 1945 rate of production. The present trend is away from coal tar chemicals to acyclic materials produced from petroleum. While the chemical production would never rise above a few per cent of the petroleum production, the stability of the plastics market and the relatively high value of the derived products provides the petroleum industry an opportunity to diversify its activities for greater economic stability.

C. H. Riesz

Thiophene Production

Rasmussen, H. E. and Ray, F. E. THIOPENE. A NEW INDUSTRIAL CHEMICAL FROM BUTANE AND SULFUR. *Chemical Industries* 60, 593-596, 620 (1947) *April.*

Thiophene, produced by the interaction of normal butane and sulfur at 150°F., is now being manufactured by Socony-Vacuum at the rate of 1000 pounds per day. Use of the compound as a low cost raw material for making potentially valuable benzene analogs is being investigated by various industries.

C. H. Riesz

Toluene Synthesis

Ipatieff, V. N. and Monroe, G. S. THE CATALYTIC FORMATION OF TOLUENE FROM BENZENE AND BENZENE-METHANE AT HIGH PRESSURES. *J. Am. Chem. Soc.* 69, 710 (1947) *March.*

Benzene plus methane passed over alumina-silica cracking catalyst at 232 atm. and 600°C. produced 4.6 wt.-% toluene whereas benzene alone yielded only 1.1 wt.-% toluene. With a nickel-silica catalyst, as high as 20.5 wt.-% of the benzene was converted to toluene in the presence of methane (1.8:1 methane-benzene ratio). The entire amount of methane essentially was recovered.

C. H. Riesz

Vapor Pressures

Stull, D. R. VAPOR PRESSURE OF PURE SUBSTANCES — ORGANIC COMPOUNDS. *Ind. Eng. Chem.* 39, 517-540 (1947) *April.*

Vapor pressure data on over 1200 organic compounds are presented.

R. S. Goodrick

Vapor Pressure of Aromatic Hydrocarbons

Griswold, J. and May, J. A. DISTILLATION PROPERTIES OF AROMATIC HYDROCARBONS. VAPOR PRESSURE CHART, IMPROVED CRITICAL TEMPERATURE AND LATENT-HEAT EQUATIONS. *Petroleum Refiner* 26, 85-88 (1947) *March.*

The demands of present day methods of manufacture of the aromatic hydrocarbons necessitate a knowlede of their vapor pressures, latent heats, and other thermal data. The American Petroleum Institute Project 44 provides much useful data in the low range. The present paper presents a Cox type chart (log P against 1/T) for the alkyl benzenes from C_6 to C_{10} by plotting Bureau of Standards data up to 1 atmosphere and drawing straight lines between the normal boiling points and the criticals. Errors are estimated at about 1.5%. Formulae for use in estimating critical pressures and temperatures and latent heats are discussed. It is pointed out that much of the data are not too recent and are of questionable accuracy.

S. Katz

10. CHEMICAL ENGINEERING

Adsorption from a Fluid Stream

Hougen, O. A. ADSORPTION FROM A FLUID STREAM FLOWING THROUGH A STATIONARY GRANULAR BED. *Chem. Eng. Progress* 43, 197-208 *"Trans. Section"* (1947) *April.*

Methods are developed for calculating the time-position-temperature-concentration conditions in both gas and solid during the adsorption of dilute gases flowing through granular beds. An analytical method is developed for isothermal conditions where a linear equilibrium relation exists between the adsorbate content of the gas and of the solid. Schumann-Furnas charts have been modified to fit this particular case of adsorption. Under the same conditions graphical methods are developed for calculating the rate constants a and b from experimental data. Graphical methods, based upon Grossman's method for heat transfer, are developed for isothermal adsorption where any equilibrium relationship exists between the adsorbate content of the gas and of the solid, and for the general case of adiabatic adsorption in gases flowing through granular beds.

Author's abstract

Air Flow

Brandt, A. D., Steffy, R. J., and Huebscher, R. G. NATURE OF AIR FLOW AT SUCTION OPENINGS. *Heating, Piping, Air Conditioning* 19, 101-108 (1947) *February.*

Studies on air flow near hood openings are presented.

J. D. Parent

Air Separation

AIR SEPARATION PRINCIPLES AND TECHNOLOGY. *Chem. Eng.* 54, 126-134 (1947) *March.*

A general and elementary discussion of the

principles underlying the liquification and fractionation of air, together with simplified entropy diagrams and flow sheets is given.

H. R. Batchelder

Cooling Towers

De Flon, J. G. EVALUATE PERFORMANCE OF INDUCED DRAFT COOLING FOR CLOSER CONTROL OF COSTS. *Petroleum Processing* 2, 249-252 (1947) *April.*

This article, written in non-technical language, treats the two types of mechanical draft towers in use: forced draft and induced draft, and presents performance curves for the more popular of the two, the counter-current induced draft tower. Use of the charts which is illustrated by examples allows the determination of the amount of water to be sprayed over the slat-type grids, the required area of the tower and size of fan from the hot and cold water temperatures, water circulation and wet bulb temperature of the cooling air. These charts, the author points out, should be considered approximate and for preliminary estimates only. Many factors not shown in the graphs must be included in the computation and hence the manufacturer should be contacted for final design recommendations. The charts may also be used for estimating the performance of an existing tower at other than design conditions. Atmospheric type towers will be described in a subsequent article.

J. J. First

Note: This article also appeared in *Oil Gas J.* 45, 129-134, 169 (1947) *March* 29.

Hypersorption

HYPERSORPTION PROCESS FOR SEPARATION OF LIGHT GASES. *Petroleum Processing* 2, 300-307 (1947) *April.*

This article is a condensation of an article by C. Berg in *Trans. Am. Inst. Chem. Engineers* 42, 665-680 (1946) abstracted in *Gas Abstracts* 2, 210 (1946).

R. S. Goodrick

Low Temperature Calorimetry

Huffman, H. M. LOW TEMPERATURE CALORIMETRY AT THE BARTLESVILLE STATION OF THE BUREAU OF MINES. *Chemical Reviews* 40, 1-14 (1947) *February.*

Because of the importance of the free energy charge, ΔF, in thermodynamic operation, its accurate determination is a major problem of contemporary chemistry. The well known relation $\Delta F = \Delta H - T\Delta S$ provides a means of evaluating it from purely thermal data. The measurement of entropy charge, ΔS, involves low temperature calorimetry, and a cryogenic laboratory for thermal measurements down to 12°K. has therefore been set up by the Bureau of Mines at Bartlesville. Methods of manufacturing liquid and solid hydrogen, using the Kapitza cycle are described, as well as the low temperature cryostat and thermometers. A correlation of effect of branching of hydrocarbons on their entropies is now in progress.

S. Katz

Multitube Condensers

Katz, D. L., Hope, R. E., Datsko, S. C. and Robinson, D. B. CONDENSATION OF FREON-12 WITH FINNED TUBES. PART II. MULTITUBE CONDENSERS. *Refrig. Eng.* 53, 315-319, 352-354 (1947) *April.*

Experimental work with finned tubed evaporators for use in large refrigerating units is correlated into design charts simplifying tube and size selection.

E. F. Davis

Sizing of Suction Piping

Ferrill, H. E. FLUID FLOW'S RELATION TO INSTALLATION AND OPERATION. *Heating, Piping, Air Conditioning* 19, 80-82 (1947) *March.*

The author points out that improper sizing of the suction piping of a refrigerator leads to lower capacity and improper oil circulation.

J. D. Parent

11. PROCESS EQUIPMENT AND INSTRUMENTATION

Electronics in Refinery Instrumentation

Considine, D. M. ELECTRONICS AIDS PROGRESS IN REFINERY INSTRUMENTATION. *Oil Gas J.* 45, 245-246, 255-256, 260, 262-265 (1947) *March* 23.

In the last few years, notable progress has been made in control and recording instruments by the substitution of electronic principles for the more conventional methods. The article describes an electronic potentiometer circuit controlled by a thermocouple and a relay operated by a thermometer or pressure gauge. Increased accuracy and speed in X-ray diffraction measurements is achieved by replacing the conventional photographic strip with a Geiger Müller counter and a recorder. Electronic amplification of infrared and ultraviolet intensities is rapidly becoming standard procedure in modern spectrometry. The polarograph is a dropping mercury electrode with an electronically amplified current recording device. The measurement of pH with comparatively rugged instruments in boiling solution and in very alkaline solutions is now possible. Brief descriptions of a number of electronically activated high vacuum pressure gauges are included.

S. Katz

Fractionation Apparatus

Litwin, H. CASCADE-TYPE TRAY INTRODUCES NEW FRACTIONATING PRINCIPLE. *Oil Gas J.* 45, 237, 239-240, 242 (1947) *March* 22.

Experimentation on fractionating apparatus performed with a view toward overcoming the fundamental weakness of the bubble tray has resulted in the design of the Koch Kaskade tray. In this apparatus vapor and liquid are brought together under uniform conditions in a series of cascades and are separated by centrifugal force. The following advantages over the conventional bubble tray are reported: approximately 50 per cent greater vapor and liquid capacity, lesser tendency toward surging and flooding at varied loads, smaller pressure drop for the same throughput and better efficiency.

J. J. First

Heat Pump

Kemler, E. N., Oglesby, S. and Pease, W. C. THE HEAT PUMP—PAST, PRESENT, FUTURE. *Refrig. Eng.* 53, 301-304, 356 (1947) *April.*

The heat pump idea dates back beyond Lord Kelvin to whom it is generally credited, but it wasn't until the last decade that the academic idea became a commercial reality. At present there are approximately 20 commercial heat pump installations in the United States and these have proved that heat pumps for industrial uses are competitive with direct thermal processes if the cost of a ton of coal is approximately equal to the cost of 900 kwh of electricity. Research work during the past few years has resulted in the development of a design which can be packaged and which has considerable application both to the home and commercial establishment. To date two manufacturers have installed several hundred package type heat pumps in residences and commercial establishments in the Middle West, South, East and Pacific Coast states. (This article is the first of a series on the development of the heat pump.)

J. J. First

Penetron

Dikmen, B. I. and Graham, O. W. THE PENETRON—ITS APPLICATION IN THE GAS INDUSTRY. *Gas* 22, 24-36 (1947) *March.*

Finding application by the gas industry in its fight against corrosion of equipment is the Penetron. This portable instrument, used for some time in refinery inspection work, utilizes gamma rays to determine wall thicknesses of pipes and vessels, liquid density, fluid level and the interface between two liquids without re-

quiring actual access to the interior of the containing vessel, and without injury to the material being inspected. Only one side of a pipe or vessel need be accessible to obtain a measurement. The gamma rays are produced by a 1 mg. radium source contained in one end of the detector or "tangential head" and are picked up by a gamma ray detector with a pre-amplifier at the other end. The number of rays reaching the detector depends upon the thickness of the pipe wall. After amplification the pulses are rectified to supply the d.c. voltage to the meter circuit. The meter reading is automatically converted to wall thickness in thousandths of an inch with an accuracy of plus or minus 3%. The equipment which weighs 40 lb. requires 110 volts, A.C., or a small gasoline engine-driven generator. It can be placed in operation in a few minutes and a reading of wall thickness requires only one minute.

J. J. First

13. NEW BOOKS

Accident Prevention Manual

National Safety Council. ACCIDENT PREVENTION MANUAL FOR INDUSTRIAL OPERATIONS. *Chicago, National Safety Council,* 1946.

Heating and Air Conditioning

Allen, R., Walker, J. H. and James, J. W. HEATING AND AIR CONDITIONING. 6th Edition *New York, McGraw-Hill,* 1946.

Heating, Ventilating and Air Conditioning Guide

American Society Heating and Ventilating Engineers. HEATING, VENTILATING AND AIR CONDITIONING GUIDE 1947. *New York, American Society Heating and Ventilating Engineers,* 1947.

This reference book contains technical data on the design and specifications of heating, ventilating and air conditioning systems, manufacturer's data, and society membership.

R. S. Goodrick

Petroleum Almanac

The Petroleum Almanac. *New York, National Industrial Conference Board,* 1946.

Statistical information is presented on production, marketing, transportation, refining, and regulation in the petroleum industry.

R. S. Goodrick

Radiant Heating

Adlam, T. N. RADIANT HEATING. *New York, The Industrial Press,* 1947.

A practical treatise on radiant heating and radiant cooling.

R. S. Goodrick

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